Training LSSVM with GWO for Price Forecasting

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***Abstract*—This paper presents a hybrid forecasting model namely Grey Wolf Optimizer-Least Squares Support Vector Machines (GWO-LSSVM). In this study, a great deal of attention was paid in determining LSSVM's hyper parameters. For that matter, the GWO is utilized an optimization tool for optimizing the said hyper parameters. Realized in gold price forecasting, the feasibility of GWO-LSSVM is measured based on Mean Absolute Percentage Error (MAPE) and Root Mean Square Percentage Error (RMSPE). Upon completing the simulation tasks, the comparison against two hybrid methods suggested that the GWO-LSSVM capable to produce lower forecasting error as compared to the identified forecasting techniques.**

Keywords*—*Grey Wolf Optimizer, Least Squares Support Vector Machiens, Time series forecasting

I. INTRODUCTION

Swarm Intelligence (SI) which is a subset Evolutionary Computation (EC) [1] discipline has become increasingly well known during the last decade and the application of this algorithms has been revolutionized in Computational Intelligence (CI) domain. Mimics the social behavior of animals or insects such as birds, ants, termites and bees, the SI algorithms govern by its remarkable features viz. robustness and flexibility. These characteristics make SI as an outstanding algorithms in solving various optimization issues. In literature, a good number of SI algorithms have been proposed such as Particle Swarm Optimization (PSO) which is based on birds flocking [2] [cite], Ant Colony Optimization (ACO) which inspired by behavior of ants seeking a path between their colony and food source [3], Artificial Bee Colony (ABC) [4] and Firefly Algorithm (FA) [5] which motivated from intelligent behavior of bees and firefly respectively and many more. These algorithms have been proven to be efficient and favorable by academia in dealing with variety of optimization issues and this includes data mining such as forecasting and classification. One of the factor that contributes to this situation is simple concept offered in SI algorithm [6]. This characteristic encourages academia not only in implementation but also to enhance the existing SI algorithm. The remarkable performance of SI has drawn much attention to the research community, which finally led to the good number of research publications in literature.

In [7, 8], gold price forecasting using PSO was presented which suggested the capability of PSO in dealing with forecasting problem with small sample size. On related work, gold price forecasting using ABC was demonstrated by [8]. Upon completion the simulation task, the ABC was proven to be superior than the identified techniques for the problem under study.

The SI algorithms not only utilized as a single method but also as hybrid algorithms, specifically with machine learning algorithms. The hybridization of SI algorithms with machine learning algorithms can be seen encouraging due to its efficiency in parameter tuning. The capability of SI in optimizing the parameters address the inefficiency of conventional factor which is man-made choice in parameter tuning. The hybrid technique of PSO with Statistical Learning Theory (SLT) method namely Least Squares Support Vector Machines (LSSVM)[9] has been presented by [10] in critical heat flux forecasting (CHF). Applied in nuclear science field, the forecasting performance of PSO-LSSVM was guided by several indices which include Mean Relative Error (MRE) suggested that the obtained results by PSO-LSSVM is superior the identified technique. In [11], a hybridization of LSSVM with Artificial Fish Swarm Algorithm (AFSA) was examined which is realized in electrical load forecasting. On the other hand, [12] presented a hybrid ACO with Support Vector Machines (SVM) for financial forecasting. Nonetheless, even though This algorithm is reported to guarantee the convergence; however the time to converge is inconsistent [13].